10/573789

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DESCRIPTION

LIGHT-EMITTING DEVICE, ORGANIC COMPOUND AND DISPLAY

TECHNICAL FIELD

The present invention relates to a novel organic compound for a light-emitting device and an organic light-emitting device (also referred to as organic electroluminescence device or organic EL device) used for a surface light source, a flat panel display, etc.

BACKGROUND ART

As for organic light-emitting device, there was an example in the past to cause light emission by applying a voltage on an anthracene vapor-deposited film (Thin Solid Films, 94 (1982) 171) and the like. In recent years, however, in view of the advantages that a large area product can be obtained more easily as compared with an inorganic light-emitting device, desired color can be attained by development of various new materials and that it can be operated at low voltage and expected as a light-emitting device with a high-speed response and a high emission efficiency, application researches for device implementation as well as materials development are vigorously conducted.

For example, as described in detail in Macromol.

Symp. 125, 1-48 (1997), an organic EL device has generally a structure comprising two layers of upper and lower electrodes formed on a transparent substrate and an organic layer comprising a light-emitting layer formed therebetween.

Recently, in addition to conventional devices utilizing fluorescence on transition from excited singlet state to ground state, devices utilizing phosphorescence via triplet exciton have been studied as represented by the following references: "Improved energy transfer in electrophosphorescent device" (D. F.O'Brien et al., Applied Physics Letters Vol. 74, No. 3, p. 422 (1999)) and "Very high-efficiency green organic light-emitting devices based on electrophosphorescence" (M. A. Baldo et al., Applied Physics Letters Vol. 75, No. 1, p. 4 (1999)). In these references, organic layers of four-layer structure are mainly used. They are composed of a hole-transporting layer, a light-emitting layer, an exciton diffusion-prevention layer and an electron-transporting layer from the side of an anode. The materials used are a carrier-transporting material and a phosphorescent material $Ir(ppy)_3$.

Further, by using various types of fluorescent organic compounds, emission of a light of ultraviolet to infrared region, and, recently, researches on various compounds are actively conducted.

Moreover, other than the above-mentioned organic light-emitting devices using low molecule materials, an organic light-emitting device using a conjugated polymer was reported by a group of Cambridge University (Nature, 347, 539 (1990)). According to this report, a film of polyphenylenevinylene (PPV) was formed using a coating system and light emission from a single layer was confirmed.

As described above, the latest progress of organic light-emitting devices is remarkable, and their characteristic possibility of attaining a thin, lightweight, light-emitting device with a high luminance at a low applied voltage, a variety of emission wavelengths, and a high-speed response suggests their applicability to various uses.

However, at present, a light output of a higher luminance or a higher conversion efficiency is still required. Moreover, there are still many problems in respect of durability such as time-dependent change during prolonged use and degradation by an atmospheric gas including oxygen, moisture and the like. Furthermore, although in consideration of application to full-color display or the like, light emission of blue, green and red with a high color purity is needed, this problem has not been sufficiently resolved.

Moreover, although a number of aromatic

compounds and condensed polycyclic aromatic compounds have been studied as a fluorescent organic compound for use in an electron-transporting layer and a light-emitting layer, etc., it is hard to say that those having sufficiently satisfying emission luminance and durability have been obtained.

Further, Japanese Patent No. 3,229,654 and Japanese Patent Application Laid-Open No. 2002-305084 can be mentioned as patent references to indole compounds related to those used in the present invention. However, they do not disclose those organic compound in accordance with the present invention characterized by having both a partial structure containing an indole ring and a partial structure containing a carbazole ring in a molecule structure.

DISCLOSURE OF THE INVENTION

It is, therefore, an object of the present invention to provide an organic light-emitting device having a light output of a high emission efficiency and a high luminance and having high durability.

It is another object of the present invention to provide a novel organic compound that enables the above object to be attained.

It is still another object of the present invention to provide an organic light-emitting device

that can be easily produced at a relatively low cost.

These objects are attained by the following means.

1. A compound having a fluorescence lifetime of 880 ms or more at 77K represented by a novel organic compound in accordance with the present invention is used in an organic light-emitting device.

2. A light-emitting layer in which the fluorescence lifetime at 77K of a host material is 5.8×10^5 or more times the fluorescence lifetime of a light-emitting material is used in an organic light-emitting device.

3. A novel organic compound of the present invention characterized by having, in a molecule, at least one partial structure comprising an unsubstituted or substituted indole ring and at least one partial structure comprising an unsubstituted or substituted carbazole ring is used in an organic light-emitting device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A, 1B and 1C are schematic views showing examples of the light-emitting device of the present invention;

FIG. 2 is a schematic perspective view showing a simple matrix type organic EL device;

FIG. 3 is a diagram showing a driving signal;

FIG. 4 is a schematic view showing an example of configuration of a panel provided with an EL device and a drive means; and

FIG. 5 is a schematic view showing a light-emitting device produced in Example.

BEST MODE FOR CARRYING OUT THE INVENTION

Using the organic compound having a long fluorescence lifetime at 77K represented by the novel compound in accordance with the present invention enables the above objects to be attained, and an organic compound having a fluorescence lifetime of 880 ms or more at 77K, more preferably 1100 ms or more is suitable.

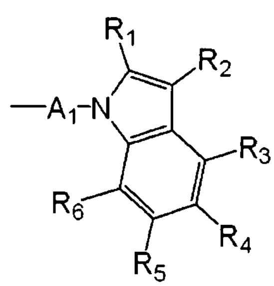
Further, it is preferable that the organic compound having a long fluorescence lifetime at 77K is used in a light-emitting layer and more preferable that the organic compound is used as a host material in a light-emitting layer comprised of at least one host material and at lest one light-emitting material.

Moreover, it is preferable that the fluorescence lifetime at 77K of the host material of the light-emitting layer is 5.8×10^5 or more times the fluorescence lifetime of the light-emitting material of the light-emitting layer.

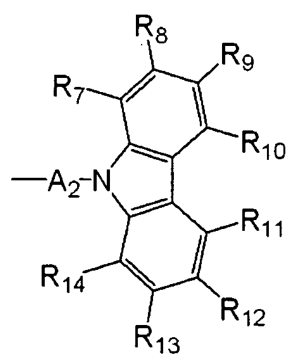
Further, it is preferable that the light-emitting material of the light-emitting layer is a

metal coordination compound, and more preferable that the metal coordination compound is an iridium coordination compound.

Moreover, the partial structure comprising an unsubstituted or substituted indole ring of the novel organic compound of the present invention includes a structure represented by the following general formula (1), and the partial structure comprising an unsubstituted or substituted carbazole ring includes a structure represented by the following general formula (2):



(1)



(2)

In the general formulae (1) and (2), A_1 and A_2 independently represents a single bond, an unsubstituted or substituted arylene group, or an unsubstituted or substituted divalent heterocyclic group and preferably include a single bond, phenylene, biphenylene, terphenylene, naphthylene, fluorenediyl, anthracenediyl, thiophenediyl, pyridinediyl, quinolinediyl, and phenanthrenediyl with phenylene, biphenylene, naphthylene, fluorenediyl, pyridinediyl,

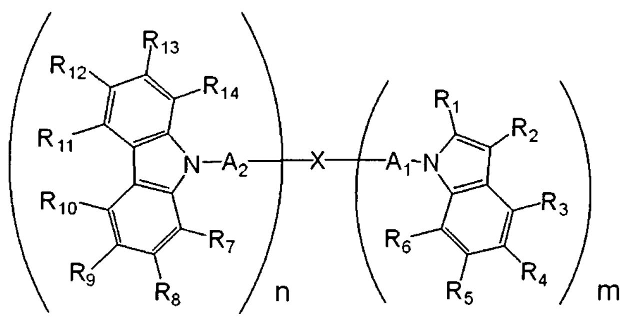
and quinolinediyl being more preferable.

Further, R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8, R_9, R_{10}, R_{11}, R_{12}, R_{13}, and R_{14} is independently selected from an hydrogen atom, a halogen atom, a linear or branched alkyl group having 1-20 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl group may be replaced by -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, or -C≡C-, or one or more methylene groups may be replaced by an unsubstituted or substituted arylene group or an unsubstituted or substituted divalent heterocyclic group, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), an unsubstituted or substituted aryl group, and an unsubstituted or substituted heterocyclic group. They are preferably a hydrogen atom, a halogen atom, a linear alkyl group having 1-10 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl group may be replaced by -O- and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), an unsubstituted or substituted phenyl group, or naphthyl group with a hydrogen atom, a fluorine atom, a bromine atom, a linear alkyl group having 1-5 carbon atoms (wherein one methylene group in the alkyl group may be replaced by -O-, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom) and an unsubstituted or substituted phenyl

group being more preferable.

Moreover, adjacent ones of R_3, R_4, R_5, R_6, R_7, R_8, R_9, R_{10}, R_{11}, R_{12}, R_{13}, and R_{14} can be bonded together to form a ring structure.

Specific examples of the organic compound having the partial structures represented by the general formulae (1) and (2) include a structure represented by the following general formula (3):



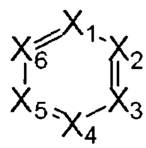
(3)

In the general formula (3), m and n are independently an integer of 1-5, preferably an integer of 1-3, and the sum of m and n is an integer of 2-6, preferably an integer of integer of 2-4.

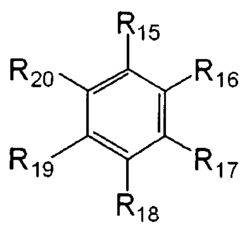
Further, X is an unsubstituted or substituted m+n valent organic group, preferably a m+n valent group having a benzene, pyridine, pyridazine, pyrazine, triazine, or tetrazine structure, and more preferably a m+n valent group having a benzene, pyridine, pyrazine, or triazine structure.

Of the compounds represented by the general formula (3), compounds represented by the following general formula (4) are preferable, and compounds

represented by the following general formula (5) are more preferable.



(4)



(5)

In the general formula (4) X_1 represents a nitrogen atom or C-R_{15}, X_2 represents a nitrogen atom or C-R_{16}, X_3 represents a nitrogen atom or C-R_{17}, X_4 represents a nitrogen atom or C-R_{18}, X_5 represents a nitrogen atom or C-R_{19}, X_6 represents a nitrogen atom or C-R_{20}, and the number of nitrogen atoms in X_1 to X_6 is 4 or less, preferably 3 or less.

In the general formulae (4) and (5), R_{15}, R_{16}, R_{17}, R_{18}, R_{19}, and R_{20} is independently selected from an hydrogen atom, a halogen atom, a linear or branched alkyl group having 1-20 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl group may be replaced by -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, or -C≡C-, or one or more methylene groups may be replaced by an

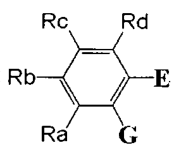
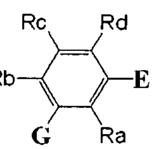
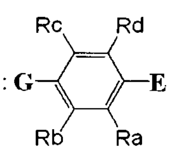
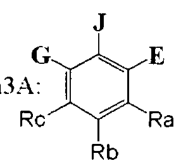
unsubstituted or substituted arylene group or an unsubstituted or substituted divalent heterocyclic group, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), an unsubstituted or substituted aryl group, and an unsubstituted or substituted heterocyclic group. They are preferably a hydrogen atom, a halogen atom, a linear alkyl group having 1-10 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl may be replaced by -O-, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), an unsubstituted or substituted phenyl group, or naphthyl group, more preferably a hydrogen atom, a fluorine atom, a bromine atom, and a linear alkyl group having 1-5 carbon atoms (wherein one methylene group of the alkyl group may be replaced by -O-, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), and an unsubstituted or substituted phenyl group.

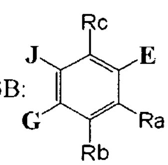
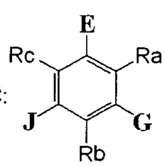
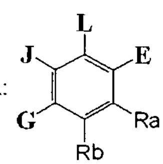
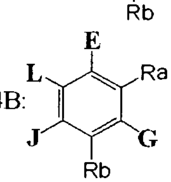
However, in the general formulae (4) and (5), at least one of R_{15} to R_{20} is a partial structure comprising an indole ring represented by the general formula (1) and at least one is a partial structure comprising a carbazole ring represented by the general formula (2), and it is preferable that at least three of R_{15} to R_{20} are each a partial structure comprising an indole ring represented by the general

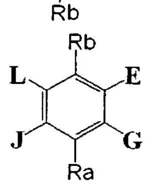
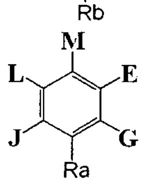
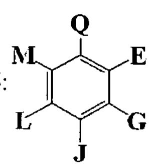
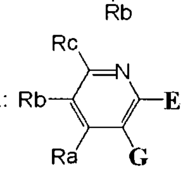
formula (1) or a partial structure comprising a carbazole ring represented by the general formula (2).

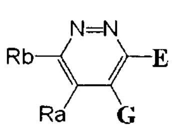
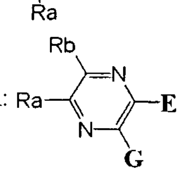
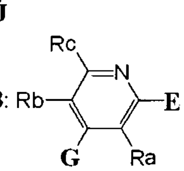
Specific structural formulae of the organic compounds represented by the general formula (3) are shown in Tables 1 to 20 below. However, these are only representative examples for the purpose of illustration and the present invention is not limited thereto.

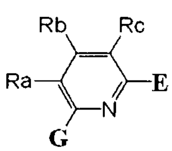
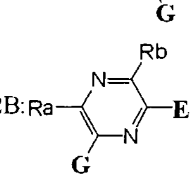
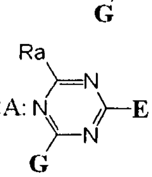
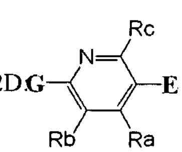
Incidentally, the abbreviations used in the column of X in Tables 1 to 20 represent the following structures. A colon ":" following the abbreviation has the meaning "represents".

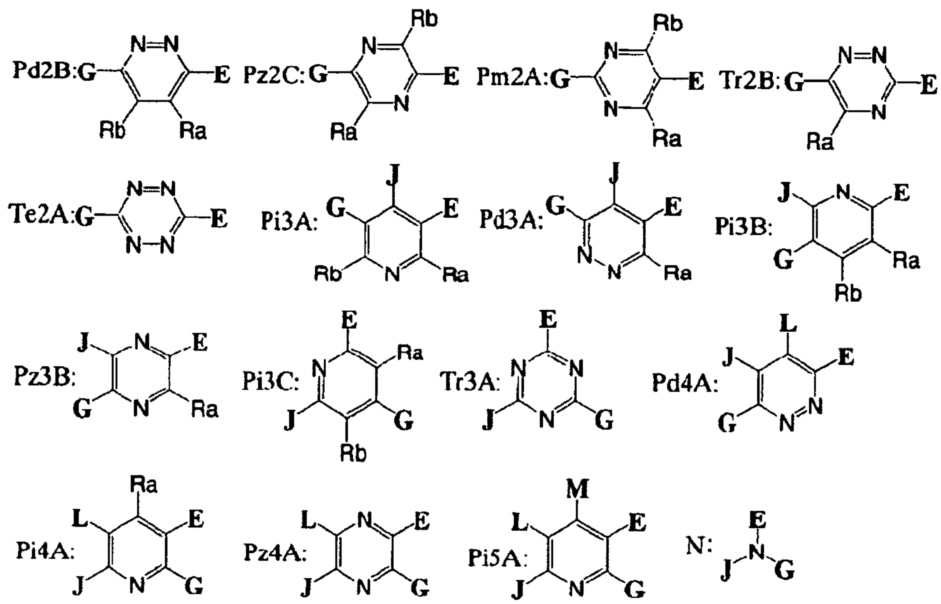
Ph2A:  Ph2B:  Ph2C:  Ph3A: 

Ph3B:  Ph3C:  Ph4A:  Ph4B: 

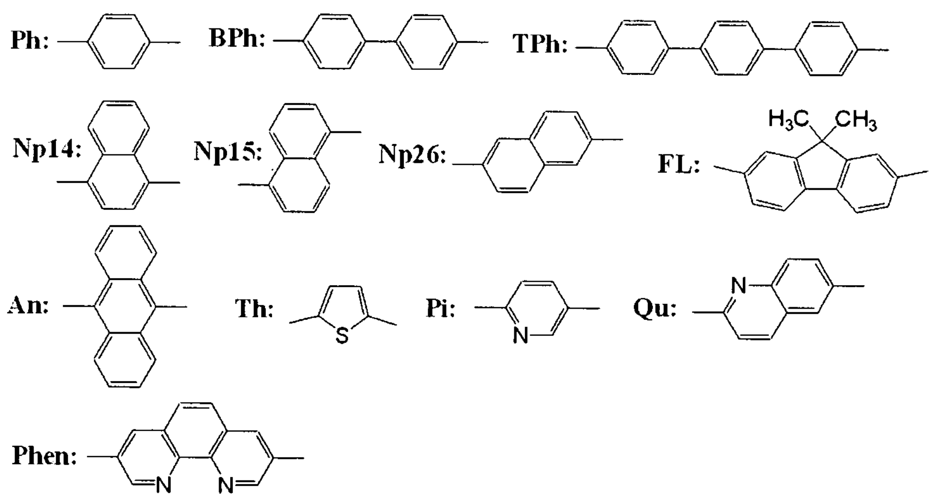
Ph4C:  Ph5:  Ph6:  Pi2A: 

Pd2A:  Pz2A:  Pi2B: 

Pi2C:  Pz2B:  Tr2A:  Pi2D: 



The abbreviations used in the columns of A_1 and A_2 represent the following structures.

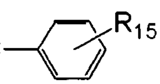


The abbreviations used in the columns of R_a to R_d and R_1 to R_{15} represent the following structures.

CH3: CH_3 OCH3: OCH_3 CF3: CF_3 C2H5: C_2H_5

C3H7: C_3H_7 OCF3: OCF_3 OC2H5: OC_2H_5

C(CH3)3: $C(CH_3)_3$ OCH2C3F7: $OCH_2C_3F_7$

Ph1:


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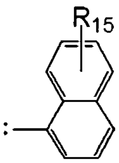

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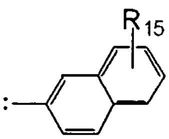

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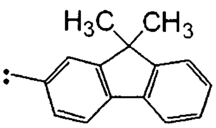

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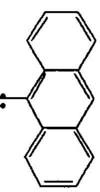

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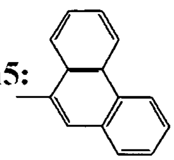

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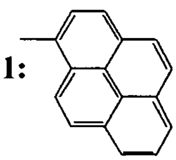

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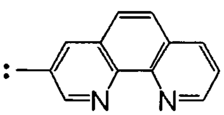


[Table 1]

No.	X	E	G	Ra	Rb	Rc	Rd	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
1	Ph2A	(1)	(2)	H	H	H	H	1	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
2	Ph2A	(1)	(2)	H	H	H	H	1	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
3	Ph2A	(1)	(2)	H	H	H	H	1	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
4	Ph2A	(1)	(2)	CH3	H	H	H	1	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
5	Ph2A	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
6	Ph2A	(1)	(2)	H	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
7	Ph2A	(1)	(2)	H	H	Br	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
8	Ph2A	(1)	(2)	H	H	H	H	1	1	BPh	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
9	Ph2A	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
10	Ph2A	(1)	(2)	H	H	H	H	1	1	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
11	Ph2B	(1)	(2)	H	H	H	H	1	1	-	Np2	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
12	Ph2B	(1)	(2)	H	H	H	H	1	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
13	Ph2B	(1)	(2)	H	H	H	H	1	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
14	Ph2B	(1)	(2)	H	H	H	H	1	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
15	Ph2B	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
16	Ph2B	(1)	(2)	H	H	H	H	1	1	TPh	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
17	Ph2B	(1)	(2)	H	F	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
18	Ph2B	(1)	(2)	H	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
19	Ph2B	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
20	Ph2B	(1)	(2)	H	H	H	H	1	1	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 2]

No.	X	E	G	Ra	Rb	Rc	Rd	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
21	Ph2C	(1)	(2)	H	H	H	H	1	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
22	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
23	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
24	Ph2C	(1)	(2)	H	H	H	H	1	1	-	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
25	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
26	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
27	Ph2C	(1)	(2)	H	H	H	H	1	1	-	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
28	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
29	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
30	Ph2C	(1)	(2)	H	H	H	H	1	1	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
31	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
32	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
33	Ph2C	(1)	(2)	H	H	H	H	1	1	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
34	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
35	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
36	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
37	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
38	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
39	Ph2C	(1)	(2)	H	H	H	H	1	1	-	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
40	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
41	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
42	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
43	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
44	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
45	Ph2C	(1)	(2)	H	H	H	H	1	1	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 2] (cont'd)

No.	X	E	G	Ra	Rb	Rc	Rd	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
46	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
47	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
48	Ph2C	(1)	(2)	H	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
49	Ph2C	(1)	(2)	Ph	H	H	Ph	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
50	Ph2C	(1)	(2)	H	H	H	H	1	1	Np26	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 3]

No.	X	E	G	J	Ra	Rb	Rc	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
51	Ph3A	(1)	(1)	(2)	H	H	H	2	1	-	H	H	H	H	H	H	An	H	H	H	H	H	H	H	H	H
52	Ph3A	(1)	(1)	(2)	H	H	H	2	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
53	Ph3A	(1)	(1)	(2)	H	H	H	2	1	-	Ph1	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	CF3
54	Ph3A	(1)	(2)	(1)	H	H	H	2	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
55	Ph3A	(1)	(2)	(1)	H	H	H	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
56	Ph3A	(1)	(2)	(1)	H	H	H	2	1	Ph	H	Ph1	H	H	H	H	Th	H	H	H	H	H	H	H	H	F
57	Ph3A	(2)	(2)	(1)	H	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
58	Ph3A	(2)	(2)	(1)	H	H	H	1	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
59	Ph3A	(2)	(1)	(2)	H	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
60	Ph3A	(2)	(1)	(2)	H	H	H	1	2	Np14	Ph1	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
61	Ph3B	(1)	(1)	(2)	H	H	H	2	1	-	H	Np1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
62	Ph3B	(1)	(1)	(2)	H	H	H	2	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
63	Ph3B	(1)	(1)	(2)	H	H	H	2	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
64	Ph3B	(1)	(2)	(1)	H	H	H	2	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
65	Ph3B	(1)	(2)	(1)	H	H	H	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
66	Ph3B	(1)	(2)	(1)	H	H	H	2	1	Np15	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCF3
67	Ph3B	(2)	(2)	(1)	H	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
68	Ph3B	(2)	(2)	(1)	H	H	H	1	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
69	Ph3B	(2)	(1)	(2)	H	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
70	Ph3B	(2)	(1)	(2)	H	H	H	1	2	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 4]

No.	X	E	G	J	Ra	Rb	Rc	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
71	Ph3C	(1)	(1)	(2)	H	H	H	2	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
72	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
73	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
74	Ph3C	(1)	(1)	(2)	H	H	H	2	1	-	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
75	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
76	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
77	Ph3C	(1)	(1)	(2)	H	H	H	2	1	-	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
78	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
79	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
80	Ph3C	(1)	(1)	(2)	H	H	H	2	1	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
81	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
82	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
83	Ph3C	(1)	(1)	(2)	H	H	H	2	1	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
84	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
85	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
86	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
87	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
88	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
89	Ph3C	(1)	(1)	(2)	H	H	H	2	1	-	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
90	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 4] (cont'd)

91	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
92	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
93	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
94	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
95	Ph3C	(1)	(1)	(2)	H	H	H	2	1	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
96	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
97	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
98	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
99	Ph3C	(1)	(1)	(2)	Ph	H	H	2	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
100	Ph3C	(1)	(1)	(2)	H	H	H	2	1	Np26	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 5]

No.	X	E	G	J	Ra	Rb	Rc	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
101	Ph3C	(1)	(2)	(2)	H	H	H	1	2	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
102	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
103	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
104	Ph3C	(1)	(2)	(2)	H	H	H	1	2	-	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
105	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
106	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
107	Ph3C	(1)	(2)	(2)	H	H	H	1	2	-	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
108	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
109	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
110	Ph3C	(1)	(2)	(2)	H	H	H	1	2	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
111	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
112	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
113	Ph3C	(1)	(2)	(2)	H	H	H	1	2	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
114	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
115	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
116	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
117	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
118	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
119	Ph3C	(1)	(2)	(2)	H	H	H	1	2	-	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
120	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 5] (cont'd)

No.	X	E	G	J	Ra	Rb	Rc	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
121	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
122	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
123	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
124	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
125	Ph3C	(1)	(2)	(2)	H	H	H	1	2	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
126	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
127	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
128	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
129	Ph3C	(1)	(2)	(2)	Ph	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
130	Ph3C	(1)	(2)	(2)	H	H	H	1	2	Np26	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 6]

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
131	Ph4A	(1)	(1)	(1)	(2)	H	H	3	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
132	Ph4A	(1)	(1)	(1)	(2)	H	H	3	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
133	Ph4A	(1)	(2)	(1)	(1)	H	H	3	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
134	Ph4A	(1)	(2)	(1)	(1)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
135	Ph4A	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
136	Ph4A	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
137	Ph4A	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
138	Ph4A	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
139	Ph4A	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
140	Ph4A	(2)	(2)	(1)	(2)	H	H	1	3	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
141	Ph4B	(1)	(1)	(1)	(2)	H	H	3	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
142	Ph4B	(1)	(1)	(1)	(2)	H	H	3	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
143	Ph4B	(1)	(2)	(1)	(1)	H	H	3	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
144	Ph4B	(1)	(2)	(1)	(1)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
145	Ph4B	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
146	Ph4B	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
147	Ph4B	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
148	Ph4B	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
149	Ph4B	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
150	Ph4B	(2)	(2)	(1)	(2)	H	H	1	3	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 7]

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
151	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
152	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
153	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
154	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	-	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
155	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
156	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
157	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	-	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
158	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
159	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
160	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
161	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
162	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
163	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
164	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
165	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
166	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
167	Ph4C	(1)	(2)	(1)	(2)	CH3	CH3	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
168	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
169	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	-	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
170	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 7] (cont'd)

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
171	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
172	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
173	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
174	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
175	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
176	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
177	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
178	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
179	Ph4C	(1)	(2)	(1)	(2)	Ph	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
180	Ph4C	(1)	(2)	(1)	(2)	H	H	2	2	Np26	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 8]

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
181	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
182	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	H	H	H	H	H	-	H	H	FL2	H	H	H	H	H	H
183	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
184	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	-	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
185	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
186	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
187	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	-	H	CH3	H	H	H	H	Qu	H	H	H	H	H	H	H	H	H
188	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
189	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
190	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
191	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
192	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
193	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	-	Ph1	H	H	H	H	H	-	H	H	An9	H	H	H	H	H	H
194	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
195	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
196	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
197	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
198	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
199	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	-	H	Ph1	H	H	H	H	Phen	H	H	H	H	H	H	H	H	H
200	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 8] (cont'd)

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
201	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
202	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
203	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
204	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
205	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
206	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
207	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
208	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
209	Ph4C	(1)	(2)	(2)	(1)	Ph	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
210	Ph4C	(1)	(2)	(2)	(1)	H	H	2	2	Np26	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 9]

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
211	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
212	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
213	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
214	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	-	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
215	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	CH3	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
216	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
217	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	-	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
218	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
219	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
220	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
221	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
222	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
223	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	Pn5
224	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
225	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
226	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
227	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
228	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
229	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	-	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
230	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 9] (cont'd)

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
231	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
232	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
233	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
234	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
235	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	-	Ph1	Ph1	H	H	H	H	-	H	H	Pr1	H	H	H	H	H	H
236	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
237	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
238	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
239	Ph4C	(1)	(1)	(2)	(2)	Ph	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
240	Ph4C	(1)	(1)	(2)	(2)	H	H	2	2	Np26	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 10]

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
241	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
242	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
243	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
244	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
245	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
246	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
247	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
248	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
249	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
250	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
251	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
252	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
253	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
254	Ph4C	(1)	(1)	(1)	(2)	H	H	3	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
255	Ph4C	(1)	(1)	(1)	(2)	Ph	H	3	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
256	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	-	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
257	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	CH3	CH3	H	H	H	H	-	H	H	H	H	H	H	H	H	H
258	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
259	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	-	Ph1	H	H	H	H	H	-	H	H	Phen9	H	H	H	H	H	H
260	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 10] (cont'd)

No.	X	E	G	J	L	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
261	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
262	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
263	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
264	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
265	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
266	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
267	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
268	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
269	Ph4C	(1)	(2)	(2)	(2)	H	H	1	3	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
270	Ph4C	(1)	(2)	(2)	(2)	Ph	H	1	3	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 11]

No.	X	E	G	J	L	M	Q	Ra	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
271	Ph5	(1)	(1)	(1)	(1)	(2)	-	H	4	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
272	Ph5	(1)	(1)	(1)	(2)	(1)	-	H	4	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
273	Ph5	(1)	(1)	(2)	(1)	(1)	-	H	4	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
274	Ph5	(1)	(1)	(1)	(2)	(2)	-	H	3	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
275	Ph5	(1)	(1)	(2)	(1)	(2)	-	H	3	2	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
276	Ph5	(1)	(2)	(1)	(1)	(2)	-	H	3	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
277	Ph5	(2)	(1)	(1)	(1)	(2)	-	H	3	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
278	Ph5	(1)	(1)	(2)	(2)	(2)	-	H	2	3	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
279	Ph5	(1)	(2)	(1)	(2)	(2)	-	H	2	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
280	Ph5	(2)	(2)	(1)	(1)	(2)	-	H	2	3	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
281	Ph6	(1)	(1)	(1)	(1)	(1)	(2)	-	5	1	-	H	H	H	H	H	H	-	H	H	Np2	H	H	H	H	H	H
282	Ph6	(1)	(1)	(1)	(1)	(2)	(1)	-	5	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
283	Ph6	(1)	(1)	(1)	(2)	(1)	(1)	-	5	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
284	Ph6	(1)	(1)	(1)	(1)	(2)	(2)	-	4	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
285	Ph6	(1)	(1)	(1)	(2)	(1)	(2)	-	4	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
286	Ph6	(1)	(1)	(2)	(1)	(1)	(2)	-	4	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
287	Ph6	(1)	(2)	(1)	(1)	(1)	(2)	-	4	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
288	Ph6	(1)	(1)	(1)	(2)	(2)	(2)	-	3	3	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	Np1
289	Ph6	(1)	(1)	(2)	(1)	(2)	(2)	-	3	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
290	Ph6	(1)	(2)	(2)	(1)	(1)	(2)	-	3	3	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 12]

No.	X	E	G	Ra	Rb	Rc	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
291	Pi2A	(1)	(2)	H	H	H	1	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
292	Pi2A	(1)	(2)	H	H	H	1	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
293	Pi2A	(1)	(2)	H	H	H	1	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
294	Pi2A	(1)	(2)	H	H	H	1	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
295	Pi2A	(1)	(2)	H	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
296	Pi2B	(1)	(2)	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
297	Pi2B	(1)	(2)	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
298	Pi2B	(1)	(2)	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	OCF3
299	Pi2B	(1)	(2)	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
300	Pi2B	(1)	(2)	H	H	H	1	1	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
301	Pi2C	(1)	(2)	H	H	H	1	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
302	Pi2C	(1)	(2)	H	H	H	1	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
303	Pi2C	(1)	(2)	H	H	H	1	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
304	Pi2C	(1)	(2)	H	H	H	1	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
305	Pi2C	(1)	(2)	H	H	H	1	1	Ph	Ph1	FL2	H	H	H	H	-	H	H	H	H	H	H	H	H	H
306	Pi2D	(1)	(2)	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
307	Pi2D	(1)	(2)	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
308	Pi2D	(1)	(2)	H	H	H	1	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
309	Pi2D	(1)	(2)	H	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
310	Pi2D	(1)	(2)	H	H	H	1	1	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	OC2H5

[Table 13]

No.	X	E	G	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
311	Pd2A	(1)	(2)	H	H	1	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
312	Pd2A	(1)	(2)	H	H	1	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
313	Pd2A	(1)	(2)	H	H	1	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
314	Pz2A	(1)	(2)	H	H	1	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
315	Pz2A	(1)	(2)	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
316	Pz2A	(1)	(2)	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
317	Pz2B	(1)	(2)	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
318	Pz2B	(1)	(2)	H	H	1	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
319	Pz2B	(1)	(2)	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
320	Pz2B	(1)	(2)	H	H	1	1	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
321	Pd2B	(1)	(2)	H	H	1	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
322	Pd2B	(1)	(2)	H	H	1	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
323	Pd2B	(1)	(2)	H	H	1	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
324	Pd2B	(1)	(2)	H	H	1	1	Ph	CH3	CH3	H	H	H	H	Th	H	H	H	H	H	H	H	H	H
325	Pz2C	(1)	(2)	H	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
326	Pz2C	(1)	(2)	H	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
327	Pz2C	(1)	(2)	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
328	Pm2A	(1)	(2)	H	H	1	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	C(CH3)3
329	Pm2A	(1)	(2)	H	H	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
330	Pm2A	(1)	(2)	H	H	1	1	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 14]

No.	X	E	G	Ra	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
331	Tr2A	(1)	(2)	H	1	1	-	H	H	H	H	H	H	BPh	H	H	H	H	H	H	H	H	H
332	Tr2A	(1)	(2)	H	1	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
333	Tr2A	(1)	(2)	H	1	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
334	Tr2A	(1)	(2)	H	1	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
335	Tr2B	(1)	(2)	H	1	1	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
336	Tr2B	(1)	(2)	H	1	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
337	Tr2B	(1)	(2)	H	1	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
338	Tr2B	(1)	(2)	H	1	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
339	Te2A	(1)	(2)	-	1	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
340	Te2A	(1)	(2)	-	1	1	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 15]

No.	X	E	G	J	Ra	Rb	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
341	Pi3A	(1)	(1)	(2)	H	H	2	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
342	Pi3A	(1)	(1)	(2)	H	H	2	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
343	Pi3A	(1)	(1)	(2)	H	H	2	1	-	Ph1	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	CF3
344	Pi3A	(1)	(2)	(1)	H	H	2	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
345	Pd3A	(1)	(2)	(1)	H	-	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
346	Pd3A	(1)	(2)	(1)	H	-	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
347	Pd3A	(2)	(2)	(1)	H	-	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
348	Pd3A	(2)	(2)	(1)	H	-	1	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
349	Pi3B	(2)	(1)	(2)	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
350	Pi3B	(2)	(1)	(2)	H	H	1	2	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
351	Pi3B	(1)	(1)	(2)	H	H	2	1	-	H	H	H	H	H	H	Np15	H	H	H	H	H	H	H	H	H
352	Pi3B	(1)	(1)	(2)	H	H	2	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
353	Pz3B	(1)	(1)	(2)	H	-	2	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
354	Pz3B	(1)	(2)	(1)	H	-	2	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
355	Pz3B	(1)	(2)	(1)	H	-	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
356	Pz3B	(1)	(2)	(1)	H	-	2	1	Np15	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCF3
357	Pi3C	(2)	(2)	(1)	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	Np26	H	H	H	H	H	H	H	H	H
358	Pi3C	(2)	(2)	(1)	H	H	1	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
359	Pi3C	(2)	(1)	(2)	H	H	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
360	Pi3C	(2)	(1)	(2)	H	H	1	2	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 16]

No.	X	E	G	J	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
361	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
362	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
363	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
364	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
365	Tr3A	(1)	(1)	(2)	2	1	-	H	Ph1	H	H	H	H	Pi	H	H	H	H	H	H	H	H	H
366	Tr3A	(1)	(1)	(2)	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
367	Tr3A	(1)	(1)	(2)	2	1	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
368	Tr3A	(1)	(1)	(2)	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
369	Tr3A	(1)	(1)	(2)	2	1	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
370	Tr3A	(1)	(1)	(2)	2	1	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
371	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
372	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	OCH2C3F7
373	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
374	Tr3A	(1)	(1)	(2)	2	1	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
375	Tr3A	(1)	(1)	(2)	2	1	Np26	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
376	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
377	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	CH3
378	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	F
379	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
380	Tr3A	(1)	(2)	(2)	1	2	-	H	Ph1	H	H	H	H	Qu	H	H	H	H	H	H	H	H	H

[Table 16] (cont'd)

No.	X	E	G	J	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
381	Tr3A	(1)	(2)	(2)	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
382	Tr3A	(1)	(2)	(2)	1	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
383	Tr3A	(1)	(2)	(2)	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
384	Tr3A	(1)	(2)	(2)	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
385	Tr3A	(1)	(2)	(2)	1	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	Cl
386	Tr3A	(1)	(2)	(2)	1	2	-	Ph1	Ph1	H	H	H	H	An	H	H	H	H	H	H	H	H	H
387	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
388	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
389	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
390	Tr3A	(1)	(2)	(2)	1	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 17]

No.	X	E	G	J	L	Ra	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
391	Pd4A	(1)	(1)	(1)	(2)	-	3	1	-	H	H	H	H	H	H	TPh	H	H	H	H	H	H	H	H	H
392	Pd4A	(1)	(1)	(1)	(2)	-	3	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
393	Pd4A	(1)	(2)	(1)	(1)	-	3	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
394	Pd4A	(1)	(2)	(1)	(1)	-	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
395	Pd4A	(1)	(2)	(1)	(2)	-	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
396	Pd4A	(1)	(2)	(1)	(2)	-	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
397	Pd4A	(1)	(2)	(2)	(1)	-	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
398	Pd4A	(1)	(2)	(2)	(1)	-	2	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
399	Pd4A	(1)	(2)	(2)	(2)	-	1	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
400	Pd4A	(2)	(2)	(1)	(2)	-	1	3	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
401	Pi4A	(1)	(1)	(1)	(2)	H	3	1	-	H	H	H	H	H	H	Qu	H	H	H	H	H	H	H	H	H
402	Pi4A	(1)	(1)	(1)	(2)	H	3	1	Ph	CH3	H	H	H	H	H	-	H	H	C2H5	H	H	H	H	H	H
403	Pi4A	(1)	(2)	(1)	(1)	H	3	1	-	H	C3H7	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
404	Pi4A	(1)	(2)	(1)	(1)	H	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
405	Pi4A	(1)	(2)	(1)	(2)	H	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
406	Pi4A	(1)	(2)	(1)	(2)	H	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
407	Pi4A	(1)	(2)	(2)	(1)	H	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
408	Pi4A	(1)	(2)	(2)	(1)	H	2	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
409	Pi4A	(1)	(2)	(2)	(2)	H	1	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
410	Pi4A	(2)	(2)	(1)	(2)	H	1	3	FL	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 18]

No.	X	E	G	J	L	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
411	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
412	Pz4A	(1)	(2)	(1)	(2)	2	2	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
413	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
414	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
415	Pz4A	(1)	(2)	(1)	(2)	2	2	-	H	Ph1	H	H	H	H	Phen	H	H	H	H	H	H	H	H	H
416	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
417	Pz4A	(1)	(2)	(1)	(2)	2	2	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
418	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
419	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
420	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
421	Pz4A	(1)	(2)	(2)	(1)	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
422	Pz4A	(1)	(2)	(2)	(1)	2	2	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
423	Pz4A	(1)	(2)	(2)	(1)	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
424	Pz4A	(1)	(2)	(2)	(1)	2	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
425	Pz4A	(1)	(2)	(2)	(1)	2	2	-	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
426	Pz4A	(1)	(2)	(2)	(1)	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
427	Pz4A	(1)	(2)	(2)	(1)	2	2	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
428	Pz4A	(1)	(2)	(2)	(1)	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
429	Pz4A	(1)	(2)	(2)	(1)	2	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
430	Pz4A	(1)	(2)	(2)	(1)	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 18] (cont'd)

No.	X	E	G	J	L	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
431	Pz4A	(1)	(1)	(2)	(2)	2	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
432	Pz4A	(1)	(2)	(1)	(2)	2	2	-	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
433	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	Phen9
434	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
435	Pz4A	(1)	(2)	(1)	(2)	2	2	-	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
436	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	CF3
437	Pz4A	(1)	(2)	(1)	(2)	2	2	-	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
438	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
439	Pz4A	(1)	(2)	(1)	(2)	2	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
440	Pz4A	(1)	(1)	(2)	(2)	2	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 19]

No.	X	E	G	J	L	M	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
441	Pi5A	(1)	(1)	(1)	(1)	(2)	4	1	-	H	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H
442	Pi5A	(1)	(1)	(1)	(2)	(1)	4	1	Ph	CH3	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	OCH3
443	Pi5A	(1)	(1)	(2)	(1)	(1)	4	1	-	H	CH3	H	Ph1	H	H	Ph	H	H	H	H	H	H	H	H	CF3
444	Pi5A	(1)	(1)	(1)	(2)	(2)	3	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
445	Pi5A	(1)	(1)	(2)	(1)	(2)	3	2	Ph	Ph1	H	H	H	H	H	-	H	H	CH3	H	H	H	H	H	H
446	Pi5A	(1)	(2)	(1)	(1)	(2)	3	2	Ph	H	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	F
447	Pi5A	(2)	(1)	(1)	(1)	(2)	3	2	Ph	Ph1	Ph1	H	H	H	H	-	H	H	H	H	H	H	H	H	H
448	Pi5A	(1)	(1)	(2)	(2)	(2)	2	3	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
449	Pi5A	(1)	(2)	(1)	(2)	(2)	2	3	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
450	Pi5A	(2)	(2)	(1)	(1)	(2)	2	3	Np14	Ph1	H	H	H	H	H	-	H	H	H	H	H	H	H	H	H

[Table 20]

No.	X	E	G	J	m	n	A_1	R_1	R_2	R_3	R_4	R_5	R_6	A_2	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}
451	N	(1)	(1)	(2)	2	1	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
452	N	(1)	(1)	(2)	2	1	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
453	N	(1)	(1)	(2)	2	1	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
454	N	(1)	(1)	(2)	2	1	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
455	N	(1)	(1)	(2)	2	1	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
456	N	(1)	(1)	(2)	2	1	Ph	H	Ph1	H	H	H	H	Np26	H	H	H	H	H	H	H	H	H
457	N	(1)	(1)	(2)	2	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
458	N	(1)	(1)	(2)	2	1	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	CH3	H	H	H	H	H	H
459	N	(1)	(1)	(2)	2	1	Ph	Ph1	Ph1	H	H	H	H	Pi	H	H	H	H	H	H	H	H	H
460	N	(1)	(1)	(2)	2	1	Np26	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
461	N	(1)	(2)	(2)	1	2	Ph	H	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
462	N	(1)	(2)	(2)	1	2	Ph	CH3	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
463	N	(1)	(2)	(2)	1	2	Ph	H	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
464	N	(1)	(2)	(2)	1	2	Ph	CH3	CH3	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
465	N	(1)	(2)	(2)	1	2	Ph	Ph1	H	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
466	N	(1)	(2)	(2)	1	2	Ph	H	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
467	N	(1)	(2)	(2)	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H
468	N	(1)	(2)	(2)	1	2	Ph	Ph1	Ph1	H	H	H	H	Ph	H	H	CH3	H	H	H	H	H	H
469	N	(1)	(2)	(2)	1	2	Ph	Ph1	Ph1	H	H	H	H	Pi	H	H	H	H	H	H	H	H	H
470	N	(1)	(2)	(2)	1	2	Np26	Ph1	Ph1	H	H	H	H	Ph	H	H	H	H	H	H	H	H	H

Next, the organic light-emitting device and image display of the present invention will be described.

Basic device configurations in accordance with the present invention are shown in FIGS. 1A, 1B and 1C.

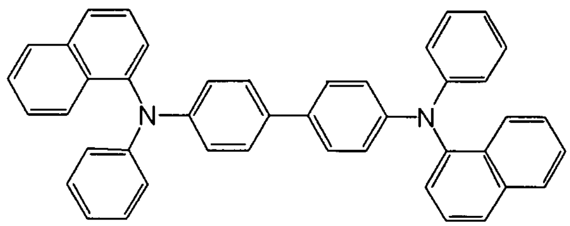
In the figures, reference numeral 11 denotes a metal electrode, 12 denotes a light-emitting layer, 13 denotes a hole-transporting layer, 14 denotes a transparent electrode, 15 denotes a transparent substrate, 16 denotes an electron-transporting layer, and 17 denotes an exciton diffusion-prevention layer.

As shown in FIGS. 1A, 1B and 1C, an organic EL device generally comprises a transparent substrate 15, on which formed are a transparent electrode 14 having a film thickness of 50-200 nm, an organic film layer of a multilayer structure and a metal electrode 11 formed to sandwich the organic film layer with the transparent electrode 14.

FIG. 1A shows an example in which the organic layer is consisted of a light-emitting layer 12 and a hole-transporting layer 13. As the transparent electrode 14, ITO or the like having a large work function is used to promote hole injection from the transparent electrode 14 to the hole-transporting layer 13. As the metal electrode 11, aluminium, magnesium or an alloy using those metals having a small work function is used to promote electron

injection to the organic layer.

Although it is preferable that the light-emitting layer 12 is formed using an organic compound of the present invention, the hole-transporting layer 13 may be formed by suitably using an electron-donative material, for example, a triphenyldiamine derivative represented by α-NPD shown below.



The device configured as mentioned above exhibits a rectifying property, and when an electric field is applied such that the metal electrode 11 is a cathode and the transparent electrode 14 is an anode, electrons are injected into the light-emitting layer 12 from the metal electrode 11, and holes are injected from the transparent electrode 15.

The injected holes and electrons recombine in the light-emitting layer 12 to form excitons thereby emitting light. At this time, the hole-transporting layer 13 plays a role as an electron-blocking layer to increase the recombination efficiency at an interface between the light-emitting layer 12 and the hole-transporting layer 13, which leads to increase in emission efficiency.

Furthermore, in the configuration shown in FIG.

1B, the electron-transporting layer 16 is provided between the metal electrode 11 and the light-emitting layer 12 the configuration of FIG. 1A. By separating the light-emitting function and the electron/hole transporting functions to attain more effective carrier-blocking structure, thereby improving the emission efficiency. As the electron-transporting layer 16, for example, an oxadiazole derivative or the like may be used.

Furthermore, as shown in FIG. 1C, it is also preferable to adopt a four-layer structure in which a hole-transporting layer 13, a light-emitting layer 12, an exciton diffusion-prevention layer 17, an electron-transporting layer 16, and a metal electrode 11 are provided in the mentioned order from the side of a transparent electrode 14 as an anode.

The organic compound of the present invention can be used as a hole-transporting material, electron-transporting material, light-emitting material, host material for dispersing a light-emitting material therein, exciton diffusion-prevention material, charge-injecting material, or the like depending on the selection of the substituent to incorporate. Of these, it can be suitably used as a host material for dispersing, for example, at least one phosphorescent material such as a metal coordination compound, e.g., an iridium

coordination compound.

The highly efficient light-emitting device in accordance with the present invention can be applied to those products requiring energy saving and a high luminance. Examples of application include a light source for a display/lighting equipment or a printer, a backlight for a liquid crystal display. When applied to a display, energy saving and provision of a high-visibility, lightweight flat panel display becomes possible. When used as a light source of a printer, a laser light source of laser beam printers now widely used can be replaced by the light-emitting device of the present invention. Independently addressable devices are disposed in an array and a desired exposure is effected to a photoconductive drum to form an image. By using the device of the present invention, the equipment volume can remarkably be reduced. As for a lighting equipment or a backlight, energy-saving effect by the present invention is expectable.

Although the device of the present invention can be used as a simple matrix type organic EL device as shown in FIG. 2, it is also envisaged as an application to a display that the system is driven by a TFT driving circuit as an active matrix system.

An example using an active-matrix substrate in a device of the present invention will be described

below with reference to FIG. 4.

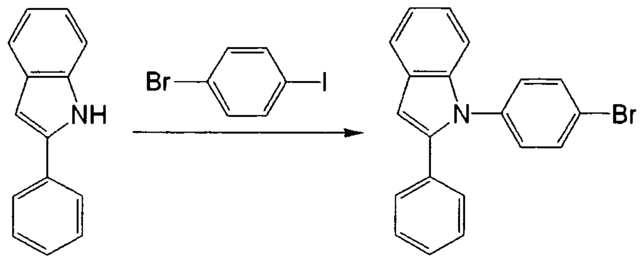
FIG. 4 schematically shows an example of the configuration of a panel equipped with an EL device and a drive means. On a panel, a scanning signal driver, an information signal driver, and a current supply source are disposed and respectively connected to gate selection lines, information signal lines and current supply lines. Display pixel electrodes are disposed at the intersections of the gate selection lines and the information signal lines. The scanning signal driver selects the gate selection lines G1, G2, G3... Gn sequentially, and an image signal is applied in synchronization therewith from the information signal driver, thereby displaying an image. An example of the driving signal is shown in FIG. 3.

There is especially no limitation in the switching device of TFT, and either one of a single-crystal silicon substrate, an MIM device, an a-Si type device and the like can readily be adopted.

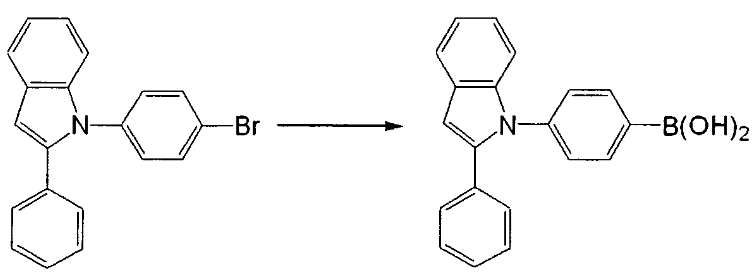
A multilayer or monolayer organic EL layer/a cathode layer may be stacked sequentially on the above-mentioned ITO electrode to obtain an organic EL display panel. The display panel using the organic compound of the present invention may be driven to attain display that is good in image quality and stable during a long period of use.

[Examples]

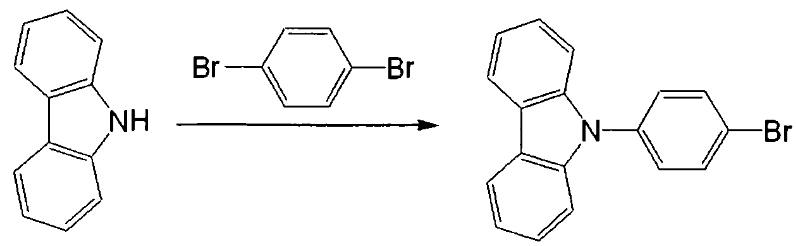
<Example 1 (Synthesis of Exemplary Compound No.34)>



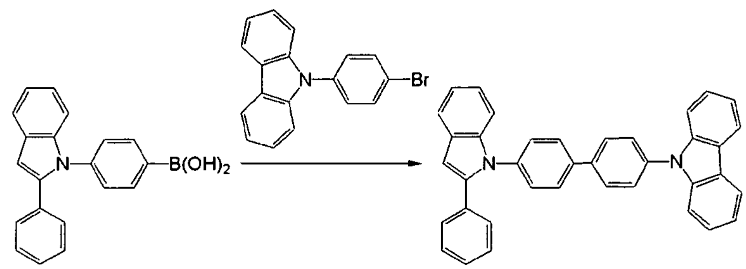
50.0 g (177 mmole) of 4-bromoiodobenzene, 28.5 g (177 mmole) of 2-phenylindole, 30.5 g (221 mmole) of potassium carbonate, 18.7 g of copper powder, and 150 ml of o-dichlorobenzene were put in a 500 ml three-necked flask, and refluxed with stirring for 25 hours under nitrogen flow. Toluene was added to the reaction mixture heated under stirring at 60°C, and insoluble matter was filtered off. The filtrate was vacuum dried. Hexane was added to the residue and deposited crystal was filtered off. The filtrate was condensed, and refined by silica gel column chromatography (eluent: hexane/ethyl acetate: 50/1), recrystallized with a mixed solvent of hexane/ethyl acetate to give 25.7 g of a white crystal of 1-(4-bromophenyl)-2-phenylindole (yield: 50.1%).



18.6 g (53.4 mmole) of 1-(4-bromophenyl)-2-phenylindole and 140 ml of dry tetrahydrofuran were put in a 1000 ml three-necked flask, and 66.7 ml (107 mmole) of 1.6 M-butylithium hexane solution was dropped slowly while keeping the temperature at -63°C to -62°C in a dry ice-acetone bath under nitrogen flow. The mixture was stirred at the same temperature for 1 hour after the dropwise addition was ended, and 23.3 g (224 mmole) of trimethyl borate was dropped slowly while keeping the temperature at -63°C to -60°C. After stirring at the same temperature for another hour, the mixture was gradually heated and left around -3°C overnight. While keeping the reaction mixture at 12°C to 13°C in an ice bath, hydrochloric acid (40 ml of concentrated hydrochloric acid diluted with 20 ml of water) was dropped slowly. This reaction liquid was poured into 1.2L of ice water, and extracted twice with 250 ml of toluene. The organic layer was washed with water, dried over magnesium sulfate and then vacuumed to dryness. The residue was recrystallized with a mixed solvent of hexane/tetrahydrofuran to give 10.3 g (yield: 61.6%) of a white crystal of 4-(2-phenylindole-1-yl)phenyl boronic acid.

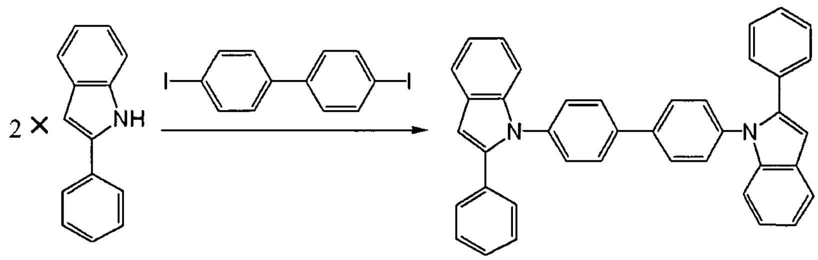


4.30 g (25.7 mmole) of carbazole, 18.19 g (77.1 mmole) of p-dibromobenzene, 0.14 g of palladium acetate and 0.33 g of 1,1'- bisdiphenyl phosphinoferrocene, 3.46 g of (36.0 mmole) sodium t-butoxide and 43 ml o-xylene were put in a 200 ml three-necked flask, and refluxed under stirring for 15 hours and 30 minutes under argon flow. The reaction mixture was filtered using a filter packed with alumina to remove insoluble matter, the filter was washed with toluene and tetrahydrofuran successively. The filtrate and wash liquid were combined and condensed under reduced pressure. Hexane was added to the residue, followed by heating and stirring, then insoluble matter was removed by filtration, and the filtrate was vacuum dried. Hexane was added to the residue and deposited crystal was filtered off. The filtrate was condensed, and refined by silica gel column chromatography (eluent: hexane/toluene: 3/1), recrystallized with hexane to give 3.68 g of a white crystal of 9-(4-bromophenyl)carbazole (yield: 44.4%).



0.78 g (2.49 mmole) of 4-(2-phenylindole-1-yl)phenyl boronic acid and 0.80 g (2.48 mmole) of 9-(4-bromophenyl) carbazole were put in a 20 ml three-necked flask, and 2.5 ml of toluene, 1.5 ml of ethanol, and 2.5 ml of 2M-sodium carbonate solution were put therein, and 0.09 g (0.08 mmole) of tetrakis-(triphenylphosphine) palladium (0) was added under stirring at room temperature under nitrogen flow. Then, the mixture was refluxed with stirring for 5 hours under nitrogen flow. After the reaction was completed, the reaction mixture was cooled to room temperature and deposited crystal was separated by filtration. The crystal was washed with acetone and recrystallized with a mixed solvent of toluene/ethanol. The obtained crystal was refined by alumina column chromatography (eluent: toluene) and crystallize with methanol to give 0.49 g of a white crystal of 4-(2-phenylindole-1-yl)-4'-(carbazole-9-yl)biphenyl (Exemplary Compound No.34)(yield: 38.6%).

<Comparative Example 1 (Synthesis of Compound A)>

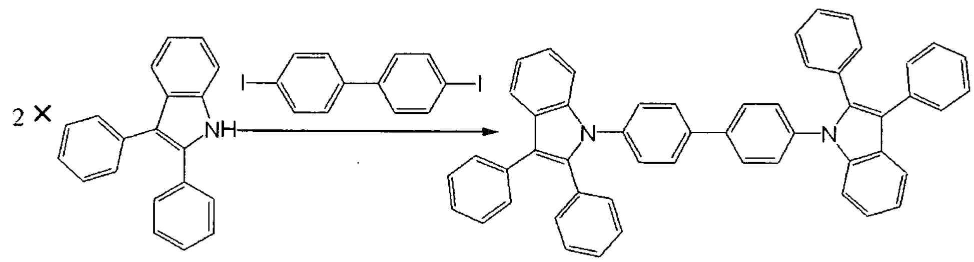


20.1 g (49.5 mmole) of 4,4'-diiodobiphenyl, 25.0 g (128.7 mmole) of 2-phenylindole, 17.8 g (128.7 mmole) of potassium carbonate, 9.4g of copper powder and 100 ml of o-dichlorobenzene were put in a 300 ml three-necked flask, and refluxed with stirring for 23 hours under nitrogen flow. After the reaction was completed, toluene was added to the reaction mixture heated at 120°C with stirring, insoluble matter was filtered off. The filtrate was cooled to -15°C and deposited crystal was filtered. The crystal was dispersed in and washed with acetone, separated by filtration, and recrystallized with N,N'-dimethylformamide added with activated carbon to give 12.7 g of a white crystal of 4,4'-bis(2-phenylindole-1-yl)biphenyl (compound A)(yield: 47.8%).

<Example 2 (Synthesis of Exemplary Compound No. 46)>

A white crystal of 4-(2,3-diphenylindole-1-yl)-4'-(carbazole-9-yl)biphenyl (Exemplary Compound No. 46) was obtained following the same procedure as in Example 1 with the exception that 2,3-diphenylindole available from Aldrich Co. was used in place of 2-phenylindole of Example 1.

<Comparative Example 2 (Synthesis of Compound B)>



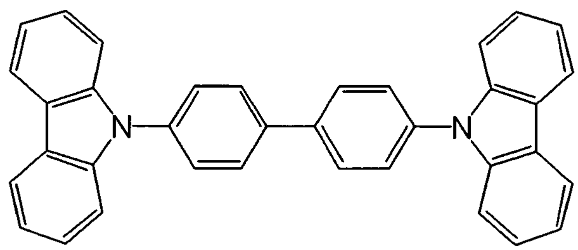
2.90 g (7.14 mmole) of 4,4'-diiodobiphenyl and 5.00 g (18.56 mmole) of 2,3-diphenylindole, 2.70 g (18.56 mmole) of potassium carbonate, 1.4g of copper powder and 100 ml of o-dichlorobenzene were put in a 300 ml three-necked flask, and refluxed with stirring for 20 hours and 30 minutes under nitrogen flow. After the reaction was completed, the reaction mixture was cooled to room temperature. Toluene and water were added thereto. The mixture was agitated and allowed to separate. The organic layer was washed with water and then vacuum dried, and the residue was recrystallized with tetrahydrofuran added with activated carbon to give 3.10 g of a crystal of 4,4'-bis(2,3-diphenylindole-1-yl) biphenyl (compound B)(yield: 63.0%).

<Measurement>

The melting point, glass transition temperature and crystallization temperatures of the four compounds synthesized in Examples 1 and 2 and Comparative Examples 1 and 2 and 4,4'-bis(carbazole-9-yl)biphenyl (DCBP available from Dojindo

Laboratories) were measured by Differential Scanning Calorimetry (DSC) using Pyris1 (trade name) manufactured by Perkin-Elmer, Inc. (Measurement conditions: heating rate of 40°C/min and cooling rate of 40°C/min). The results of these measurements are shown in Table 21. Incidentally, the structural formula of DCBP is shown below.

DCBP :



[Table 21]

	Compound	Melting point (°C)	Glass transition temperature (°C)	Crystallization temperature (°C)
Example 1	Exemplary Compound No. 34	238.0	100.8	Not crystallized to 0°C
Comparative Example 1	Compound A	282.5	Not detectable	202.5
Example 2	Exemplary Compound No. 46	255.3	121.5	Not crystallized to 0°C
Comparative Example 2	Compound B	354.0	Not detectable	280.5
-	DCBP	287.8	Not detectable	205.4

It can be seen from these results that as compared with the compounds which has only indole rings (compounds A and B) or the compound which has

only carbazole rings (DCBP), the compounds of the present invention (Exemplary Compounds 34 and 46) which has both an indole ring and a carbazole ring have a stable glass state, and the present compounds can be expected to form a stable amorphous film by vapor deposition or the like.

Furthermore, the compounds of the present invention (Exemplary Compounds 34 and 46) have a larger solubility to an organic solvent than Compounds A and B and DCBP, and can be easily refined by recrystallization or column chromatography.

<Example 3>

As a device structure, a device in which the organic layer was composed of three layers as shown in FIG. 5 was used.

On a glass substrate (transparent substrate 15) was formed an ITO layer (transparent electrode 14) in a thickness of 100 nm by patterning such that the area of the electrode was 3.14 mm^2. On the thus formed ITO substrate, the following organic layers and electrode layers were vapor deposited by resistive heating in a vacuum chamber of 10^{-4} Pa to perform continuous film formation.

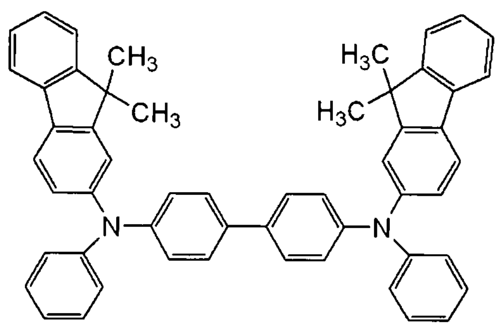
Hole-transporting layer 13 (40 nm): Compound C;
Light-emitting layer 12 (40 nm): Host material + predetermined amount of light-emitting material;
Electron-transporting layer 16 (30 nm): Bphen;

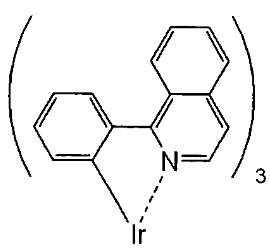
Metal electrode layer 11-2 (15 nm): KF; and

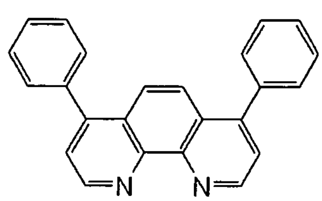
Metal electrode layer 11-1(100 nm): Al

A device was prepared using Exemplary Compound 34 as a host material of the light-emitting layer 12 doped with Ir complex (compound D) as a light-emitting material at a concentration of 10% by weight.

The structural formulae of Compound C, Compound D and Bphen are shown below in the named order, respectively.





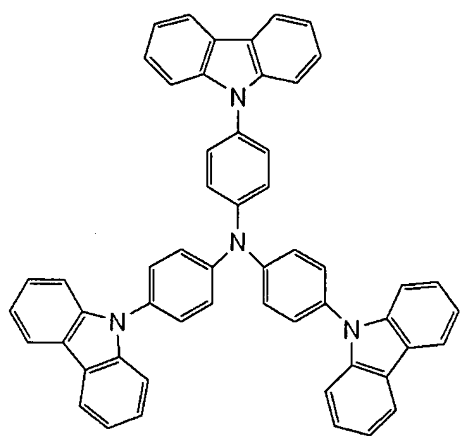


This device achieved a current efficiency of 8.5 cd/A and a power efficiency of 5.9 lm/W at a

luminance of 600 cd/m^2. The peak of the emission spectrum at this time was 620 nm, and the CIE chromaticity coordinates were (0.68, 0.32).

Comparison of these values with those in the cases where Compound A, DCBP, and TCTA are used as host material is shown in the following table. Incidentally, the structural formula of TCTA is as shown below.

TCTA:



[Table 22]

Host material	Current efficiency (cd/A)	Power efficiency (lm/W)	Current density under application of 8 v (mA/cm^2)	Efficiency saturation current (mA/cm^2)	Phosphorescence lifetime (ms)
DCBP	5.9	1.9	2.0	0.4	532
TCTA	7.1	4.0	94.0	0.8	600
Compound A	7.6	3.6	21.7	0.8	825
Exemplary Compound No. 34	8.5	5.9	244.7	8.0	1136

As can be seen from the table, the compounds of the present invention having both a carbazole group and an indole group in the molecule structure as a host material have the advantages that more current can be passed therethrough in the case where the same voltage is applied to the device, and therefore the device can be driven at a lower voltage to improve the power efficiency (Advantage 1), and that the efficiency saturation current is large, and therefore a high efficiency can be attained even at a high luminance (Advantage 2).

The term "efficiency saturation current" as employed herein is intended to mean, in terms of the relation between current density and current efficiency, a current density value at a point where the current efficiency begins to decrease with the increase in the current density, as an index of triplet exciton saturation. When a triplet light-emitting material is used as an emission center, because the excitation lifetime thereof is long, a phenomenon is known to occur in which if the amount of current flowing through the device becomes large, the triplet exciton is saturated to lower the emission efficiency. Particularly, improvement in this phenomenon is remarkable. This shows that the decrease in efficiency by the triplet saturation also varies depending on the type of host, and shows that

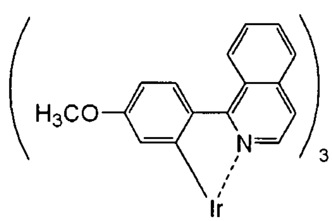
the longer the phosphorescence lifetime of the host, the larger the improvement, wherein the term "phosphorescence lifetime" as employed herein means the time period in which the amount of light after excitation of a triplet emission peak decreases to a half value and is measured and compared at liquid nitrogen temperature (measured by Hitachi fluorescence analyzer F4500. The compounds of the present invention that have both a carbazole group and an indole group in the molecule structure other than those shown in the table each have a long phosphorescence lifetime.

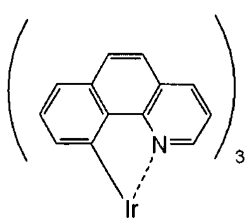
The method of measuring the phosphorescence lifetime of host materials employed herein is as follows. A host material is dissolved in toluene to prepare a solution of 10^{-6} mole/L. This solution is irradiated with an excitation light pulse of 2 ms with a Xe lamp in liquid nitrogen (77K), and the time period in which the amount of light of a peak of fluorescent spectrum decreases to its half value after excitation is measured by a fluorescence spectrophotometer F-4500 available from Hitachi and defined as the phosphorescence lifetime.

For example, Compound B has a phosphorescence lifetime of 580 ms while Exemplary Compound 46 a phosphorescence lifetime of about 880 ms.

Moreover, when a host material is double-doped

with Ir complexes (Compound E and Compound F) as phosphorescent materials, an effect is also observed. When such an Iridium complex having a substituent is used as a phosphorescent material, because the material in itself is hard to pass a current therethrough, it is important to use a host that passes an electric current therethrough like Exemplary Compound 34. Incidentally, the structural formulae of Compounds E and F are shown below respectively in the mentioned order.





Further characteristic of the compound of the present invention which has a carbazole group and an indole group in the molecular structure is that the highest occupied molecular orbital (HOMO) can be lowered than the compounds having only a carbazole group or an indole group, which leads to an effect of facilitating injection of holes into a dopant and an

effect of lowering the lowest unoccupied molecular orbitals (LUMO) to improve electronic injection property. Values of HOMO measured by the Ultraviolet Photoemission Spectroscopy (UPS) are shown in the table below and are 5.65 eV to 5.9 eV for DCBP and TCAT which are compounds having only a carbazole group and are 5.75 eV to 5.93 eV for Compounds A and B which are compounds having only an indole group while the value is deeper as 6.05 eV for Exemplary Compound 34 having both of a carbazole group and an indole group in the molecule structure.

[Table 23]

Material	DCBP	TCTA	Compound A	Compound B	Exemplary Compound No. 34
HOMO (eV)	5.9	5.65	5.93	5.75	6.05

As for band gap, as compared with DCBP having a band gap of 3.4 eV, compounds having an indole group tend to have a narrower band gap. For example, it is 2.87 eV for Compound A. This is also considered to be one of the factors of increasing current. Also in this point, the compound differs from the compound disclosed in Macromol. Symp. 125, 1-48 (1997) above.

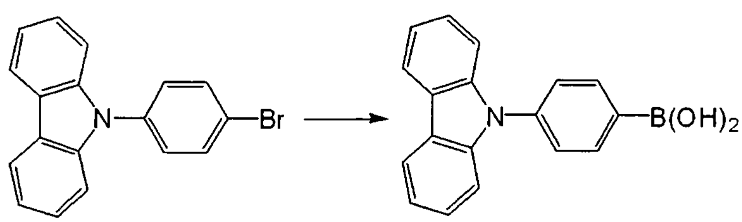
In order to prevent quenching of the triplet luminescence, the lowest triplet excitation energy level of the host material needs to be higher than the lowest triplet excitation energy level of the

phosphorescent material, and as shown in the following table, the lowest triplet excitation energy levels of the compounds (DCBP, TCTA) having only a carbazole group is higher than the lowest triplet excitation energy levels of the compounds (Compound A, Compound B) having only an indole group. By using the compounds (Exemplary Compound 34, Exemplary Compound 46) that have a carbazole group and an indole group in the molecular structure, the lowest triplet excitation energy level can be raised than the compounds having only an indole group.

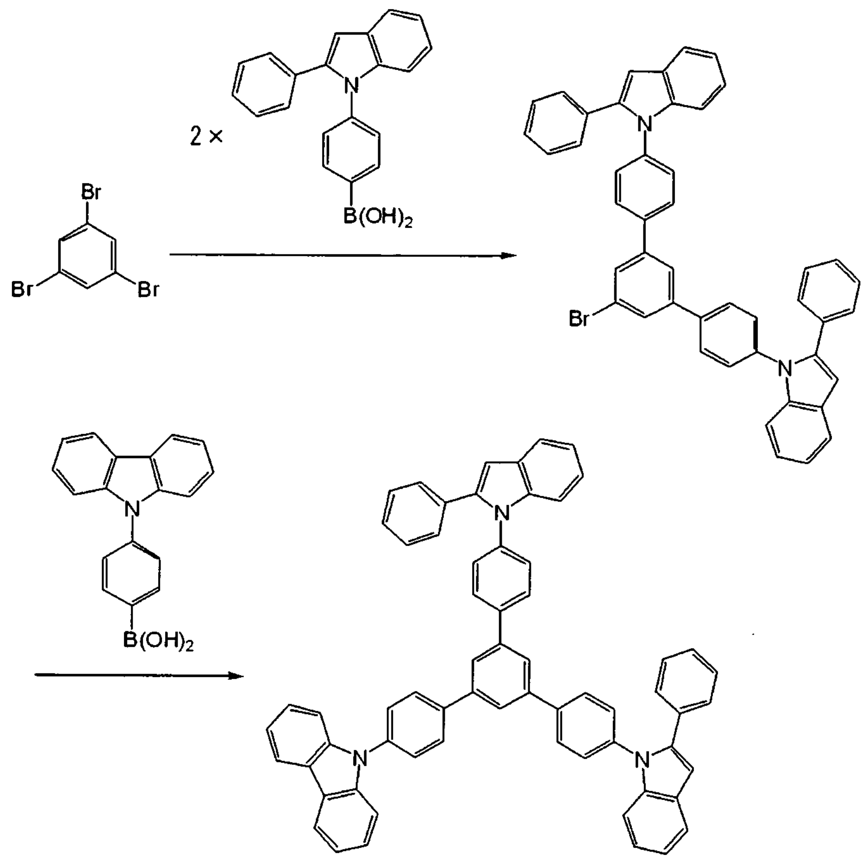
[Table 24]

Material	DCBP	TCTA	Compound A	Compound B	Exemplary Compound No. 34	Exemplary Compound No. 46
Lowest triplet excitation energy (eV)	2.61	2.84	2.48	2.44	2.49	2.45

<Example 4 (Synthesis of Exemplary Compound No.85)>



4-(carbazole-9-yl)phenyl boronic acid was synthesized following the same procedure as in Example 1 using 9-(4-bromophenyl)carbazole synthesized in Example 1.



Two equivalent weights of 4-(2-phenylindole-1-yl)phenyl boronic acid was reacted with 1,3,5-tribromobenzene available from Aldrich to synthesize 1-bromo-3,5-bis{4-(2-phenylindole-1-yl)} benzene, and the above-mentioned 4-(carbazole-9-yl)phenyl boronic acid was reacted therewith to give 1-{4-(carbazole-9-yl)phenyl}-3,5-bis{4-(2-phenylindole-1-yl)}benzene. The melting point of this compound was 347°C, and the glass transition temperature was 166°C.

<Example 5 (Synthesis of Exemplary Compound No.97)>

1-{4-(carbazole-9-yl)phenyl}-3,5-bis{4-(2,3-diphenylindole-1-yl)}benzene was obtained following

the same procedure as in Example 4 with the exception that 4-(2,3-diphenylindole-1-yl)phenyl boronic acid was used in place of 4-(2-phenylindole-1-yl)phenyl boronic acid of Example 4.

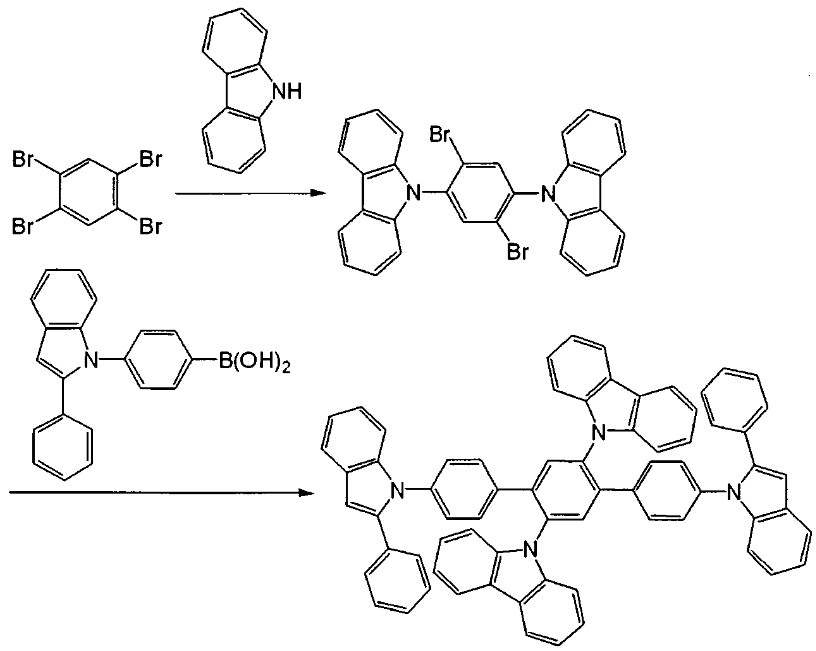
<Example 6 (Synthesis of Exemplary Compound No.115)>

By following the same procedure as in Example 4 with the exception that 4-(carbazole-9-yl)phenyl boronic acid was used in place of 4-(2-phenylindole-1-yl)phenyl boronic acid of Example 4 and 4-(2-phenylindole-1-yl)phenyl boronic acid was used in place of 4-(carbazole-9-yl)phenyl boronic acid, 1-{4-(2-phenylindole-1-yl)phenyl}-3,5-bis-{4-(carbazole-9-yl)phenyl}benzene was obtained. The melting point of this compound was 407°C, and the glass transition temperature was 174°C.

<Example 7 (Synthesis of Exemplary Compound No.127)>

By following the same procedure as in Example 6 with the exception that 4-(2,3-diphenylindole-1-yl)phenyl boronic acid was used in place of 4-(2-phenylindole-1-yl)phenyl boronic acid of Example 6, 1-{4-(2,3-diphenylindole-1-yl) phenyl}-3,5-bis-{4-(carbazole-9-yl)phenyl}benzene was obtained.

<Example 8 (Synthesis of Exemplary Compound No.164)>



1.16 g (6.1 mmole) of copper iodide and 200 ml of anhydrous dioxane were put in a three-necked flask of 300 ml, 0.41 ml (6.1 mmole) of diaminoethane was dropped at room temperature under nitrogen flow, and the mixture was stirred for 15 minutes at room temperature and heated to 60°C. This solution was allowed to cool to room temperature, 56.8 g (244 mmole) of potassium phosphate, 12.0 g (30.5 mmole) of 1,2,4,5-tetrabromobenzene and 40.8 g (244 mmole) carbazole were added, and heated with stirring at 80°C under nitrogen flow for 48 hours. After the reaction was completed, the reaction mixture was hot-filtered using Celite to remove insoluble matter. The filtrate was concentrated under reduced pressure. The residue was refined by NH-modified silica gel silica gel column chromatography (eluent: hexane/toluene:

1/2). The obtained crystal was repeatedly recrystallized from toluene and chloroform to give 0.90 g of a white crystal of 1,4-dibromo-3,6-di(carbazole-9-yl)benzene (yield: 5.2%). By reacting two equivalent weight of 4-(2-phenylindole-1-yl)phenyl boronic acid with this 1,4-dibromo-3,6-di(carbazole-9-yl)benzene, 1,4-di(carbazole-9-yl)-2,5-bis{4-(2-phenylindole-1-yl)phenyl}benzene was obtained. The melting point of this compound was 376°C, and the glass transition temperature was 184°C.

<Example 9 (Synthesis of Exemplary Compound No.176)>

By following the same procedure as in Example 9 with the exception that 4-(2,3-diphenylindole-1-yl)phenyl boronic acid was used in place of 4-(2-phenylindole-1-yl) phenyl boronic acid of Example 8, 1,4-di(carbazole-9-yl)-2,5-bis-{4-(2,3-diphenylindole-1-yl)phenyl}benzene was obtained.

<Example 10>

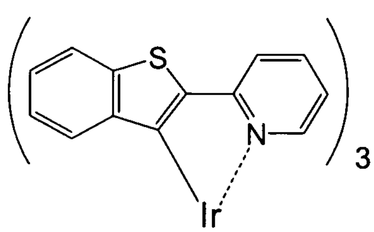
The phosphorescence lifetimes of Compound D mentioned above and Compound G and $Ir(ppy)_3$ shown below were measured using the following measuring method. An Ir complex was dissolved in a mixed solvent of toluene/ethanol/methanol in a mixing ratio of 5:4:1 by weight to prepare a solution of 10^{-6} mole/L. This solution was solidified in liquid nitrogen (77K) and irradiated with an excitation light pulse (wavelength: 337.1 nm) of 5 ns with a

nitrogen laser (LN120C; manufactured by Laser Photonics Ltd.), and the time period in which the amount of light of a peak of fluorescent spectrum decreases to its half value after excitation was measured by C4334 Streakscope (manufactured by Hamamatsu Photonics) and defined as the phosphorescence lifetime. Compound D had a phosphorescence lifetime of 1.5 μs at 77K while Compound G and $Ir(ppy)_3$ had phosphorescence lifetimes of 7.8 μs and 4.6 μs at 77K, respectively.

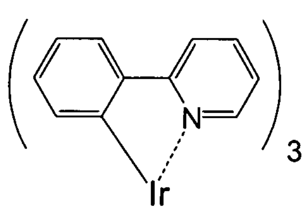
In this example, devices of the structure having 4 organic layers shown in FIG. 1C were made and compared with one another. For each device, an alkali-free glass substrate was used as the transparent substrate 15, and an indium tin oxide (ITO) layer of 100 nm in thickness was formed thereon by sputtering and then patterned to prepare the transparent electrode 14. The above-mentioned α-NPD was vacuum evaporated thereon in a thickness of 40 nm as the hole-transporting layer 13. The organic light-emitting layer 12 was formed thereon in a thickness of 30 nm by using the above-mentioned various compounds as host materials and using the above Compounds D and G and $Ir(ppy)_3$ as a light-emitting material through coevaporation in a ratio of 8% by weight. Further, BCP shown below was vacuum evaporated thereon in a thickness of 10 nm as the

exciton diffusion-prevention layer 17. Then, Alq3 shown below was evaporated thereon by resistive heating at a vacuum degree of 10^{-4} Pa to give an organic film of 30 nm in thickness as the electron-transporting layer 16. Then, an Al-Li alloy layer is disposed in a thickness of 15 nm as an underlying layer for the metal electrode layer 11. Further, as the metal electrode 11, an aluminium film of 100 nm in thickness was evaporated thereon and patterned in such a shape that the area of the electrode facing the transparent electrode 14 is 3 mm^2. A current-passing endurance test was performed by applying a 12V DC voltage to the thus made device with the ITO electrode being used as an anode and the Al electrode being used as a cathode, and the time it took for the emission luminance to decrease to its half value was measured.

Compound G



Ir(ppy).



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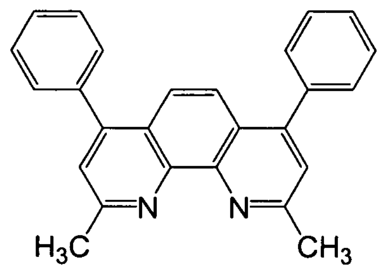

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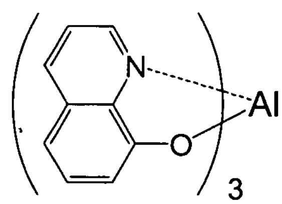

The combination of host material and light-emitting material of the light-emitting layer, the value of (phosphorescence lifetime of host material)/(phosphorescence lifetime of light-emitting material), and the time it takes for the emission luminance to decrease to its half value (simply referred to as "luminance half-value time") for each device are shown in Table 25.

Table 25

Light-emitting Layer		(phosphorescence lifetime of host material)/(phosphorescence lifetime of light-emitting material)	Luminance half-value time (hrs)
Host Material	Light-emitting material		
DCBP	Compound G	6.8×10^4	850
DCBP	$Ir(ppy)_3$	1.2×10^5	350
DCBP	Compound D	3.6×10^5	1550
Compound B	Compound D	3.9×10^5	1450
Compound A	Compound D	5.5×10^5	1600
Exemplary Compound No. 46	Compound D	5.9×10^5	4550
Exemplary Compound No. 34	Compound D	7.6×10^5	4600

It has been confirmed from the above results that use of a light-emitting layer in which the fluorescence lifetime at 77K of a host material is 5.8×10^5 or more times the fluorescence lifetime of a light-emitting material in an organic light-emitting device remarkably improves degradation of luminance of the device and is therefore an effective means to provide a device with high durability.

This application claims priority from Japanese Patent Application Nos. 2003-392090 filed November 21,

2003 and 2004-325838 filed November 10, 2004, which are hereby incorporated by reference herein.